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USING KEYPAD-BASED GROUP PROCESS SUPPORT SYSTEMS TO FACILITATE STUDENT REFLECTION

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Abstract

This paper outlines a number of examples of ways in which a keypad-based group process support system has been used to provide students with opportunities for reflective feedback. The examples given are; presentation review by peers, discursive course evaluation, diagnostic peer review in collaborative groups and sharing meaning in a strongly interpretive course. The emphasis in the examples is upon the use of these systems as qualitative tools that can be integrated into a range of face-to-face learning situations to promote and support student reflection upon aspects of the learning process.

Keywords

Learning, group process support system, keypad

Introduction

This paper outlines practical ways in which a keypad-based Group Decision Support System (GDSS) has been used by the author in a number of undergraduate and postgraduate information systems courses since 1995. The system has been used to support students through peer review processes for presentations and group-work, to explore interpretations of course evaluation instruments and, more recently, as a tool to support the sharing of meaning. In all cases the technology takes a low level role that supports face-to-face interaction in classroom settings.

Mallach (1994) defines a GDSS as 'an information system whose primary purpose is to provide knowledge workers with information on which to base informed decisions'. Young (1989) describes the key feature of such systems as being that '... they are intended to interact with and enhance the special mental capabilities of the user, thereby facilitating learning, creativity...'. A key word in the name of these systems is 'support', that is, they enhance the process they are supporting by providing rapid data capture, effective processing tools and immediate feedback to the participants. A key element in these systems is that of the human facilitator who is responsible for design and management of the process. The system combines the skills of the human agents working within the group with the storage and processing capabilities afforded by computer systems.

In the business world these systems are used to support a wide range of group sense-making activities in such areas as knowledge management, quality, business process re-engineering, focus groups and a wide variety of other processes. They are particularly useful for face-to-face processes that have some element of self-assessment where open and honest feedback is required. In traditional meetings the power structures within the group typically inhibit some members from voicing opinions that may be controversial or unpopular, and quiet members of the group may not feel able participate. The anonymity afforded by GDSS is a powerful feature that can help combat these difficulties.

There are two types of face-to-face GDSS in common use, namely keyboard-based and keypad-based. Keyboard-based systems typically utilise a number of networked personal computers while keypad-based systems provide each group member with small numeric keypads linked by wireless or infra-red. The

keyboard-based system allow full text to be entered by group members and have a range of software tools that allow group processes to be structured and managed to achieve given ends. These systems are ideal for such activities as brainstorming where all ideas are recorded for future analysis and development. They allow participants to work in parallel rather than 'round robin' style and as a result offer high levels of productivity. Keypad systems typically have greater use in the later stages of problem solving or in discussion activities where they can be used to rapidly gain insight to levels of group consensus or 'punctuate' the process with a variety of support tools. Keyboard systems are typically limited to less than 20 participants but keypad systems can accommodate several thousand participants if required. One such system was used with 5,000 citizens in New York to explore six redevelopment models for the World Trade Centre Site (OptionFinder, 2003)

In an educational setting the main use of such systems is not typically focused upon decision making but more upon enhancing group process, leading to such systems also being more appropriately referred to as Group Process Support Systems (GPSS). (Jones, C., Gear, A., Connolly, M. and Read, M., 2001). The systems can support teaching approaches that emphasise knowledge transfer and testing and also for open-ended learning where the prevailing learning paradigm is interpretive or constructivist in nature. In the former role they can provide instant feedback to learners of their performance against an established answer to a question, whereas in the latter role they are used in manner that supports exploration of the material under consideration. Horowitz (2003) notes that some areas of use for such systems are:

- Communication: create an environment in the classroom where differences in answers and opinions as a group can be observed and discussed immediately on tabulation while keeping each students specific response anonymous
- Learning desire and commitment: provide students with frequent indicators of both individual and group learning progress
- Customized instruction: provide a means for both pre-planned and ad hoc questioning including the opportunity for students themselves to initiate the solicitation of class responses
- Data collection: capture data on student responses divided into demographic categories to facilitate course revisions etc

Mitchell (2001) suggests that they can also be used for more mechanistic purposes such as monitoring class attendance via individual handsets, providing instant marking and feedback and for gathering data that can be used to support research activities related to classroom processes

Hunt, A., Irving, A., Read, M. and Knight S (2003) report the use of the Teamworker keypad system in a first-year information systems unit, decision making in a third-year psychology course and with second-year BSc Pharmacy students. In the pharmacy course questions were posed via the keypad and the resulting answers discussed by the whole group. A key issue here is that what is being sought is not necessarily the 'correct' answer but instead an examination and exploration of all answers and the reasons that individuals give for selecting a specific answer. They report that students expressed enthusiasm (via a questionnaire at the end of the final practical session) for the system, particularly in its ease of use, the ability to discuss answers immediately after making their choice and in the way it helped students identify where further reading was required. Importantly they also found it to be fun to use. Having wrong answers explained was found to be particularly useful. Some reservations were expressed in the need to wait for others to answer questions and in the inability to change their minds once the answer was transmitted. They also indicated that more time required to think about the questions before answering would have been beneficial.

The remainder of the paper outlines four examples of the author's use of keypad systems in undergraduate and postgraduate courses in the UK and Australia. In all cases the system has been used as a tool to encourage students to share their views and understanding and to adopt a more critical and reflective approach to learning.

Examples of use

Example 1: Peer review of student presentations

This session was carried out in a second year Data Communications Networks subject at a UK university in 1995. This was a small group of students (seven) and use was made of a wired-keypad decision support system (OptionFinder) to provide an opportunity for the students to obtain feedback from peers as well as the staff member during a presentation session. This approach was adopted in response to the student group expressing unease at having to make short presentations as part of the assignment work. They had carried out similar presentations in other subjects but felt that a simple mark for the previous presentations had not allowed them to learn from the process and consequently improve their presentation skills. To establish student ownership of the process a set of ten presentation criteria was developed by the students;

A - Introduction and summary: Did the presentation have a good introduction and summary
B - Up-to-date: Did the presentation seem to be based upon up to date information?
C - Accuracy: Did the material seem to be accurate
D - Comprehensive: Did the material seem to be comprehensive, or too shallow/deep
E - Structure: Did the structure (flow, logic) seem to be correct
F - Clarity: Was the presentation clear - were keywords explained
G - Timing: Did the presentation make good use of the recommended time allocation
H - Pace: Did the speaker present at a reasonable pace
I - Audiovisual aids: Did the speaker make good use of OHP or other audio-visual aids
J - Interest: Was the presentation interesting

These questions were entered into the keypad system prior to the actual presentation session, each item being allocated with an eight point scoring scale.

After each presentation the audience was asked to review the performance of the presenter in line with the above criteria, expressing their views anonymously via their individual keypads. Once all presentations had been completed each student's score profile was displayed via a data projector onto a large screen for discussion. The strong and weak points were discussed, firstly by the whole student group then by member of staff. Emphasis was placed on the shape of the scores and on comparative ratings rather than upon the raw numbers. The profiles of two students are shown in Figure 1, below:

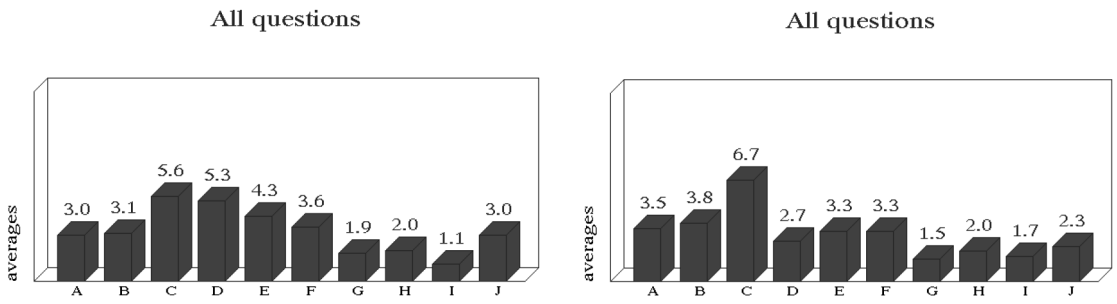

Figure 1: Two student profiles for presentation peer reviews. Letters relate to questions

The students all felt that the session had provided valuable, useful and critical but non-threatening insight to their presentations as well as exposing them to an interesting process. This was a small group that knew each other well, but, even so, considerable time was spent prior to the actual session making sure that the students would be comfortable with exposure of their scores to their fellow students. The main comment made by the students was that this would be a useful exercise for all students to go through early in their studies with subsequent sessions to help them determine if they had improved any areas of perceived weakness.

The member of staff did not vote but made notes that would generate a formal mark for each individual. The student feedback was used to 'fine tune' the formal mark. It is possible for the member of staff to

use a keypad with a different weighting applied to their keypad but in this instance it was felt that only formative feedback to the students would be appropriate as part of the 'public' peer review.

Example 2: Quality Assurance Subject Evaluation Meeting

This session was used to help develop an understanding of the way in which students approached the completion of paper-based subject evaluation questionnaires at a UK university in 1996. Although such survey instruments offer a quick and easy feedback mechanism the author was not convinced that significant decisions should be made on the future survival of courses on the basis of such a simplistic instrument. A significant concern was that of the likelihood that students would each use a different set of values when scoring the items leading to data that would be inconsistent and unreliable. It was therefore suggested to the School Quality Manager that the OptionFinder wired-keypad group process support system could be used to help the students explore interpretations and to determine if this approach would offer a more consensual approach to the provision of feedback. The Quality Manager in the School of Engineering and IT agreed to a trial of this idea and offered a small group of nine students from an electronic engineering course that he taught. The author did not to use his own students as this may have biased their willingness to offer critical comments given that final grades for the courses had not been issued at that time.

The students were asked to participate in a one-hour discussion and feedback session. The approach adopted was, firstly, for the students to score the items using the keypad without any discussion (Poll 1). The same scoring scheme was used for the keypad system as for the normal paper-based form, with a score of '6' indicating a 'very satisfied' response and '1' indicating 'very dissatisfied'. When all items had been completed the scores for each item were shown in turn to the students and they were invited to comment and discuss the distribution of scores. After discussion each items was scored again (Poll 2). The results for the two polls are shown in Table 1. The average scores are shown in the table but it is the shape of the distribution that is more revealing and four items are graphed in Figure 2. In the 'Extent to which learning outcomes are met' the average score does not change but the shape of the second poll results suggest a movement towards consensus from the broad spread of results in the first poll. This may be accounted for both by a sharing of the basis on which this item was scored and by reminding the students of what the original learning outcomes actually were. The 'Quality of feedback' was also originally broadly interpreted and the second poll also suggests moves towards consensus, with a more critical view being taken of this item.

QA session March 12 1996		**6**	**5**	**4**	**3**	**2**	**1**	**Ave**
Support for independent study	(Poll 1)	1	3	3	2	0	0	2.7
	(Poll 2)	1	6	2	0	0	0	2.1
Quality of course materials	(Poll 1)	0	2	3	3	1	0	3.3
	(Poll 2)	0	1	6	2	0	0	3.1
Extent to which learning outcomes are met	(Poll 1)	1	1	4	3	0	0	3
	(Poll 2)	0	1	7	1	0	0	3
Helpfulness of tutors comments	(Poll 1)	1	3	5	0	0	0	2.4
	(Poll 2)	1	2	6	0	0	0	2.6
Standard of teaching	(Poll 1)	0	0	6	2	1	0	3.4
	(Poll 2)	0	2	5	2	0	0	3
Clarity of assessment methods/marking criteria	(Poll 1)	0	2	2	4	1	0	3.4
	(Poll 2)	0	1	5	3	0	0	3.2
Quality of feedback	(Poll 1)	1	4	1	3	0	0	2.7
	(Poll 2)	0	5	4	0	0	0	2.4
Overall satisfaction with the unit	(Poll 1)	1	0	4	4	0	0	3.2
	(Poll 2)	0	2	4	3	0	0	3.1

Table 1: Scores for two polls, all items

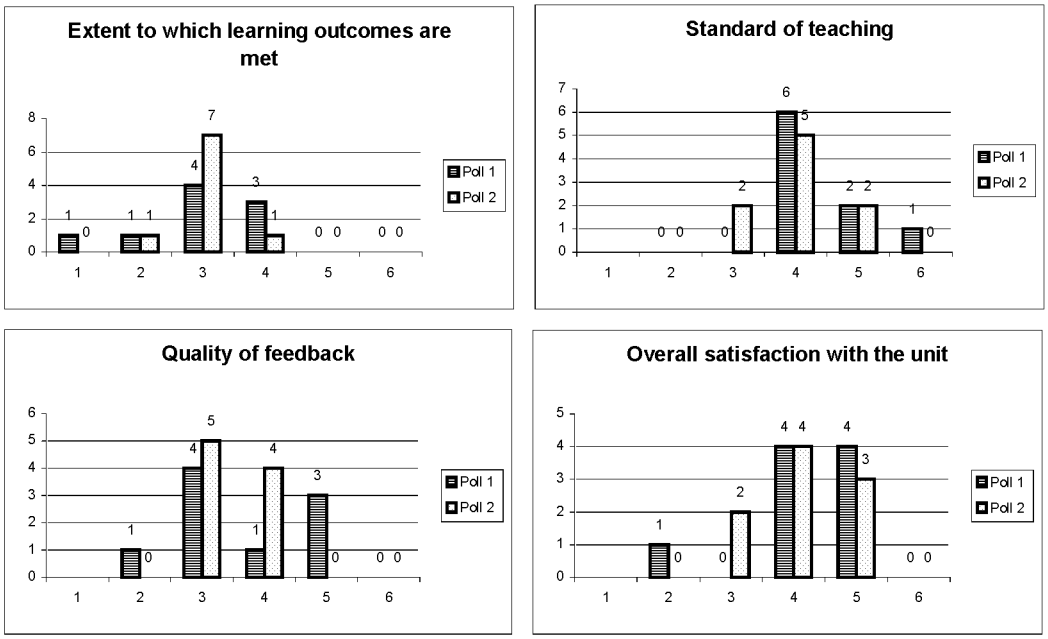

Figure 2: Graphical representation of two polls for four items

This meeting was originally scheduled to last for one hour but the students asked if it could be extended as they felt the exploration was useful and interesting. The session eventually occupied a little over one and half hours and the students expressed a high degree of satisfaction with the process. It was interesting to note that some students had used criteria that lay outside the scope of the actual course being evaluated during the first poll. These included access to library and other resources, references to other courses being studied or previously studied, the degree as a whole and one comment that 'the Coke machine is always empty'. This suggests that in many instances the students were not initially evaluating the specific course but instead a much broader range of issues. In the second poll the focus was much more clearly centred on the course and specific lecturer.

The lecturer concerned was pleased with the outcome as he felt that the feedback was more accurate, even though in some cases the average score fell from first to second poll. Only by discussion did the students realise that they shared a number of concerns that they would have ignored as individuals. This sharing of significant concerns led to tangible benefits for the students as several points raised during the session concerning defects in the physical learning environment were quickly remedied providing them with longer term benefits.

A neutral, non-participant observer (the Head of School of IT) was invited to the actual session to provide an independent view of both process and resulting data. The introduction of an observer was in response to some concerns expressed by the Dean of Engineering and IT who had a strongly positivistic leaning and was somewhat suspicious of any softer 'IS'-based approaches. One of the perceived problems with the use of facilitated meetings that permit anonymity is that they reveal issues in a brutally honest way and this can be uncomfortable or threatening for some people. Despite the use of an observer, who reported very favourably on the session, the Dean still expressed a feeling that the group had in some way been manipulated 'because the averages have fallen'. These approaches need to be used with an awareness of their ability to surface issues that some would prefer to be hidden and careful consideration given to the political environment within which they are used.

An interesting side effect that was noticed was that during the session students sometimes requested a re-poll because they had inadvertently reversed the scoring scale, ie scored a 1 instead of a 6. The potential for scale reversal clearly has some implications for evaluation systems and this issue was explored using a keyboard system (GroupSystems) some years later. The use of a keyboard-based system allowed students to express not only their score but also explain why they selected that actual score, the reasons

being entered into the system. Examination of the data showed clear evidence of scale reversals and the use of criteria beyond the course being evaluated, these criteria including the university as whole, library, previous courses and so on.

Example 3: Peer review of collaborative group-work

This example relates to current activities on a current Masters course titled 'Collaboration and E Commerce' offered by the School of Accounting and Information Systems at the University of South Australia. The aim of this course is to explore key issues in collaborative aspects of a range of issues on the e-commerce domain. The students work in teams of five, writing conference style papers that are subjected to multiple reviews by other groups as well as by staff. The students are encouraged to consider topics such as group formation and development, trust, communication and process management and to explore these in the light of their actual experiences in the course. Given the strong emphasis on group working it was decided that electronic peer review would be included in the course to help identify individual contributions to the group effort. Initially this review was used for assessment purposes at the end of the course but, at the suggestion of the students, it has been extended to include a 'diagnostic' session in week four of the ten-week course. This presents the students with an opportunity to offer their perceptions of one another from within the safety of anonymous input and to be aware of how other group members perceive them in the light of a number of criteria. The items used for the assessment were developed by the students. Students each have an infra-red keypad (from Interactive Meetings and Learning, IML) and use this to rate each other member of the group in turn. When all data has been gathered each individual is invited to comment on their profiles and the member of staff leads a discussion about ways to remedy any problems that are identified. Typical profiles are shown in figure 3.

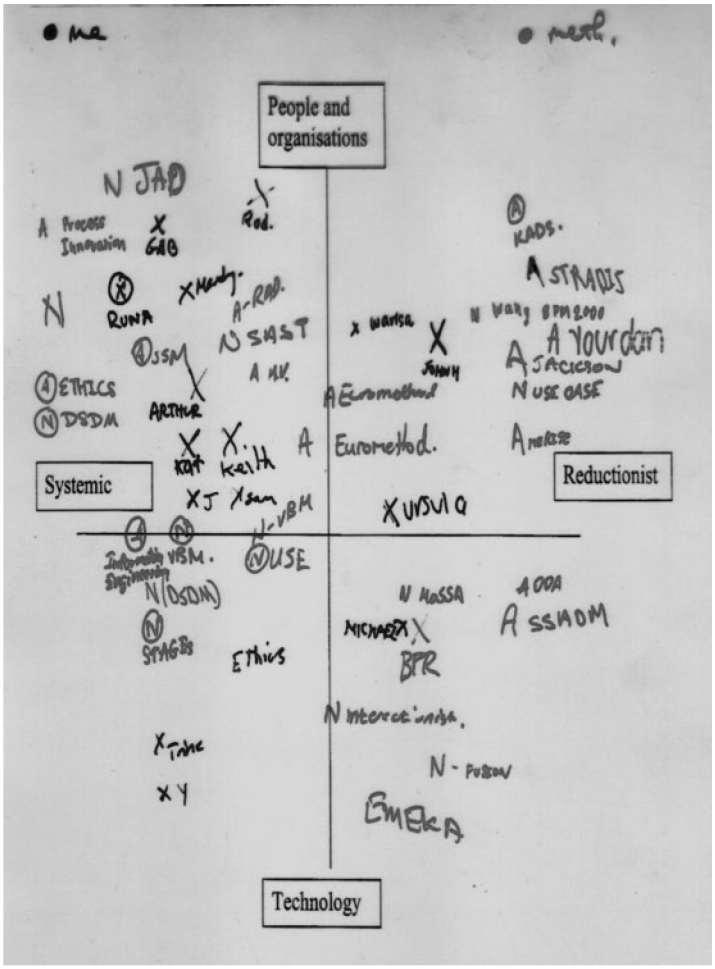

Figure 3 - profiles of strong and weaker students

At the end of each group session the results are printed out for the students to reflect upon. The process is quite time-intensive, typically requiring a full three-hour session to work through the process with ten groups. The most recent version of the course does have students who study externally and their ratings of other students are submitted via email and added in with the other
data to provide a complete picture for the groups.

Students generally found this session to be very useful even though it did not offer many surprises to the more astute groups. It did, however, offer an opportunity for the facilitator to relate their progress to the usual 'forming/storming/norming/performing' graph, suggest ways of dealing with recalcitrant members of the group or sparsely contributing external students and to point out ways of dealing with the common problem of unequal language abilities within the groups. At a later discussion one student commented that they felt uncomfortable with some negative feedback that was obtained but this was countered by a number of students who expressed the view that only by becoming honestly aware of the way that they were being perceived could they modify their behaviour. In future sessions two members of staff will be used, the first member conducting the diagnostic session and the second member spending more time de-briefing the groups. As for all of the examples given so far this is a time consuming process but it is felt that it uncovers and allows discussion of some significant issues for learners. Students from cultural backgrounds where criticism of others is problematic find the anonymity afforded by the system to be a significant feature. Students appear to be willing to openly talk about the data relating to themselves as if it represented another person and this provided an opportunity for critical reflection that they had not previously experienced.

Example 4: Sharing interpretations

In this example the technology is mainly being used to automate an existing interactive learning process that has been developed for a Masters course titled 'Information Systems Development Methodologies' (ISDM). This information systems course is located strongly at the interpretivist end of the positivist/ interpretivist spectrum. The course does not set out to offer students fine grain detail of any specific development approach, instead aiming to help them consider ways in which one or more of the several thousand available methodologies may be appropriate for specific projects, within specific organisational settings, and within the context of their own individual 'hard-soft' orientation. The underlying line of argument offered to the students is that even though 'hard' or 'soft' tools and techniques may be adopted it is important to recognise that individual developer characteristics (their worldview) may influence the way in which those tools are used. For example a developer with a 'soft' orientation may still use 'hard' tools and techniques but these will be used differently when compared with a developer with a 'hard' worldview. This individual orientation, can be viewed as representing the underlying 'philosophical' aspect of the term 'methodology' that differentiates it from 'method' or a collection of 'procedures techniques, tools and documentation aids', (Avison and Fitzgerald, 1995).

Early versions of the course (2000 onwards) suggested that students needed some kind of detailed structure, or map, to help them initially classify the various interpretations of methodologies and to identify relationships between them. The framework described by Bell and Wood-Harper (Bell and Wood-Harper, 1998) was adopted at an early stage in the course development as a useful initial map onto which student interpretations of a variety of methodologies could be plotted as a focus for discussion. The vertical axis represents a leaning towards 'people and organisations' through to a leaning towards technology, the horizontal axis ranging from systemic to reductionist.

In the current version of the course the students express their interpretations of the location of both their own worldviews and those relating to a given methodology by using an overhead projector slide printed with the grid. This allows other students to see what issues were taken into account when the location was being determined by the presenting student. Different students typically locate the target methodology at differing places on the grid, thus offering the opportunity for deeper discussion. A typical 'map' generated by a group of fifteen students is shown in Figure 4. This approach, combined with various role-play exercises, repertory grids and debates, appears to work well, and supports the sharing of meaning and the development of deep learning.

Group size has so far been small, in the region of 15 - 25, but will rise in term 1, 2004 to the more typical 60 to 80 students per course, requiring a change to the current processes. To cater for this growth, and still stay within the prescribed allocation of contact time, a keypad system is being introduced to allow more timely acquisition of individual views without encroaching on discussion time. All students will study a number of common methodologies, as before, but the grid location of their interpretations for a given methodology will be captured by way of their individual keypads. For example, all students will be asked to indicate, using the keypads, where they feel that Soft Systems Methodology would be located on the map. Once the data has been captured (a matter of one or two minutes) the resulting distributions of interpretations for the target methodology can be discussed as before. As will be noted from the slide in Figure 4, the data generated by 15 students quickly clutters the area and the amount of data captured from a larger group will further aggravate the situation. An added benefit of using software is that layering of the acquired data should offer a clearer picture for discussion of the mapping of each individual methodology while also allowing all data to be mapped onto a single space for inter-methodology comparison purposes

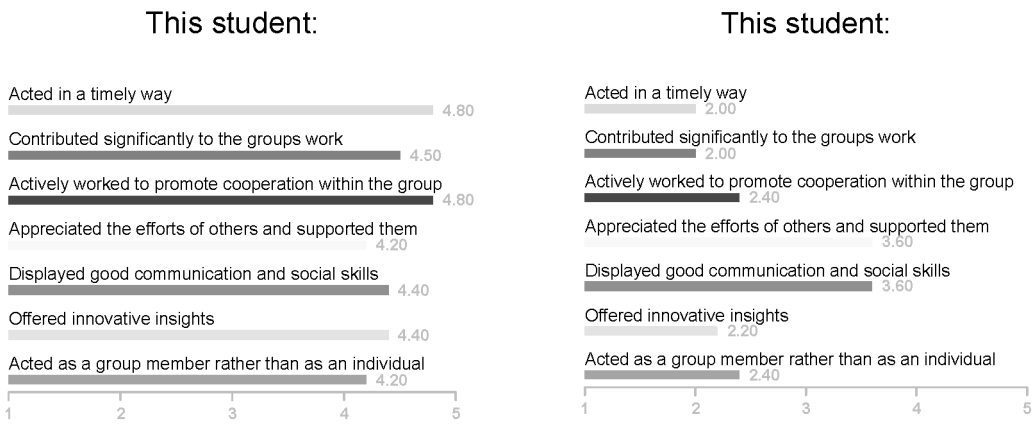

Figure 4: Results of 15 students carrying out basic interpretive mapping

The system may also be introduced into the role-play session in which each student takes the role of a key figure in information systems literature and applies the thinking of that actor to a common case study. It is envisaged that the keypad system will be used to gain feedback from the rest of the group about the strength of argument presented for each methodology presented in the context of the common case study. The questions may be developed around those shown in Example 1, above although with a stronger emphasis on issues relating to strength of argument. Current re-design of the course in readiness for the 2004 sessions is allowing consideration to be given to a deeper embedding of the technology into the learning process.

Conclusion

This paper has briefly outlined a variety of uses for keypad-based group process support systems. The tool has been integrated into the learning process to allow students to engage with the learning process in an interactive and reflective way. Keypad systems offer a light, portable, and interactive tool that can be used to support small or large groups in a wide variety of subjects and environments. Unlike traditional text-entry systems, keypads are unobtrusive and provide the opportunity for ‘punctuation’ marks in learning that provide students with the opportunity to dynamically participate in a safe environment. They can be used to provide anonymity in situations where the cultural background of students may normally lead them to be reticent about providing comment on the way that they perceive other students they work with or in critically discussing aspects of their own perceived performance. Although keypads only have the facility for numeric input they can be used to promote and support highly interactive qualitative sessions as well as being useful for quantitative assessment of progress if required. Keypad systems have become particularly attractive recently as their purchase price and hire costs have fallen considerably, for example, keypads can be hired in Australia for around $5 per day plus a small setup fee. (Keepad.com, 14/05/

2003). There are indications that as technology improves the keypads will become the size of credit-cards and will be shrink-wrapped with some course books.

Keypad-based systems do need to be used with care. If over-used or inappropriately used they could quickly lose impact and lead to uncritical 'button pushing' and student detachment. Despite their obvious uses in aiding pacing and content management in face-to-face lecture environments their main benefits may lie in smaller group work. If they are used as an integral part of the overall reflective learning process they can be used to support groups in deep and rich exploration of complex issues where multiple perspectives and belief systems are present.

The possibilities for the use of such interactive systems are limited only by the combined imagination of the learning facilitator and the learner and can be integrated in a wide range of quantitative and qualitative subject areas. Nunamaker et al, suggest that teachers new to using such systems adapt to them very quickly and that the main difficulty is that of adopting 'a new teaching paradigm unsupported by past experience, text-books, teacher-manuals, activity books or any other resources that would help them figure out what to do with the GSS once they have it.' (Nunamaker J. F., Briggs R. O., Mittleman, D. D., Vogel, D. R. and Balthazard, P. A.) These comments may have some truth in the case of complex systems but keypad-based systems are simple to learn to use and can readily be aligned with existing educational theories and processes.

These systems offer an opportunity to build on modern educational paradigms which emphasise collaborative learning rather than knowledge transfer from teacher to learner. The increased availability combined with the falling cost of these systems present great opportunities to integrate them into the learning environment to achieve rich and rapid interaction with learners and to significantly impact on the learning process.

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